

Nov. 9 , 1926.

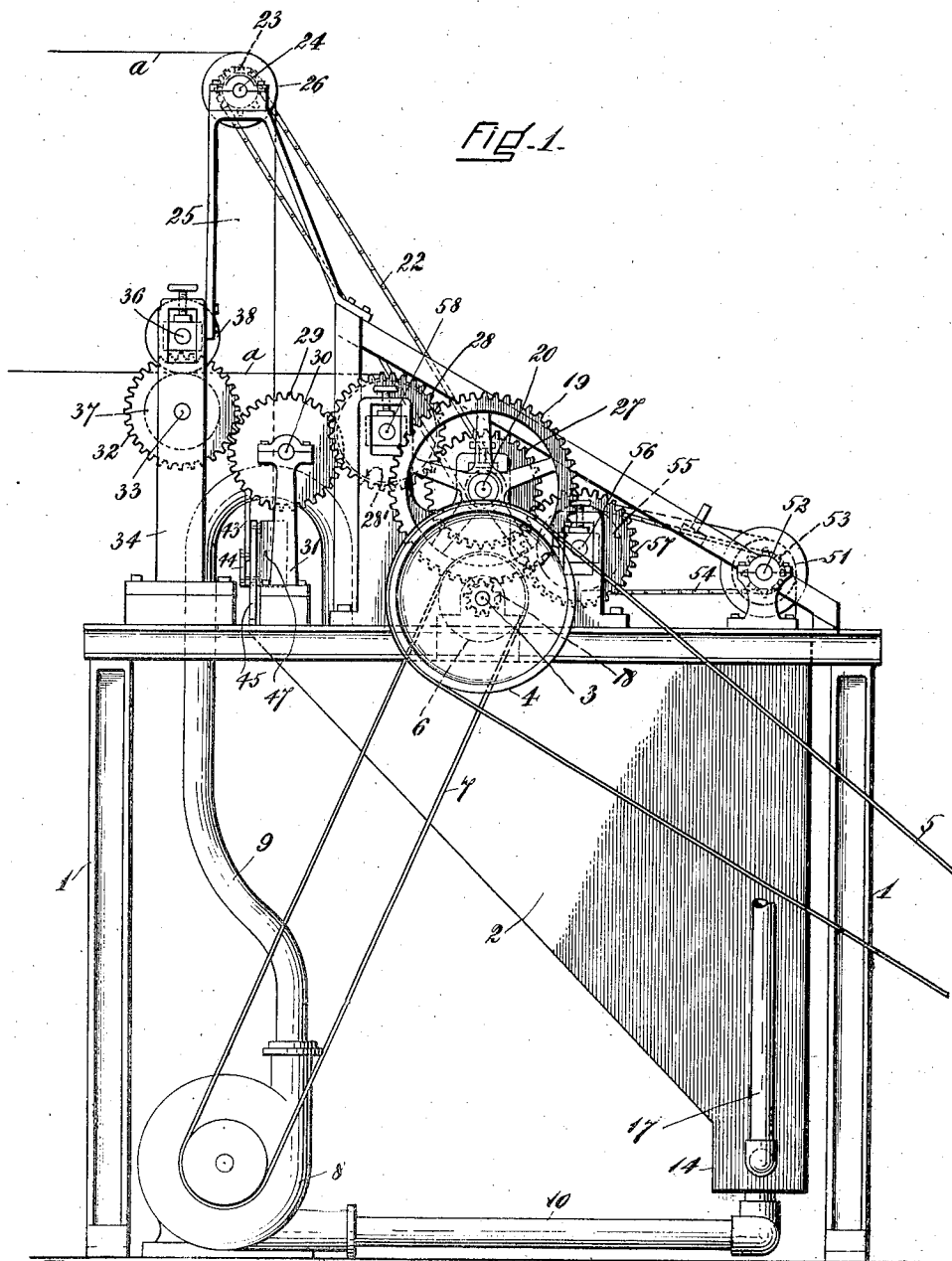
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METHOD AND APPARATUS FOR DYEING

Filed Jan. 31, 1923

5 Sheets-Sheet 1



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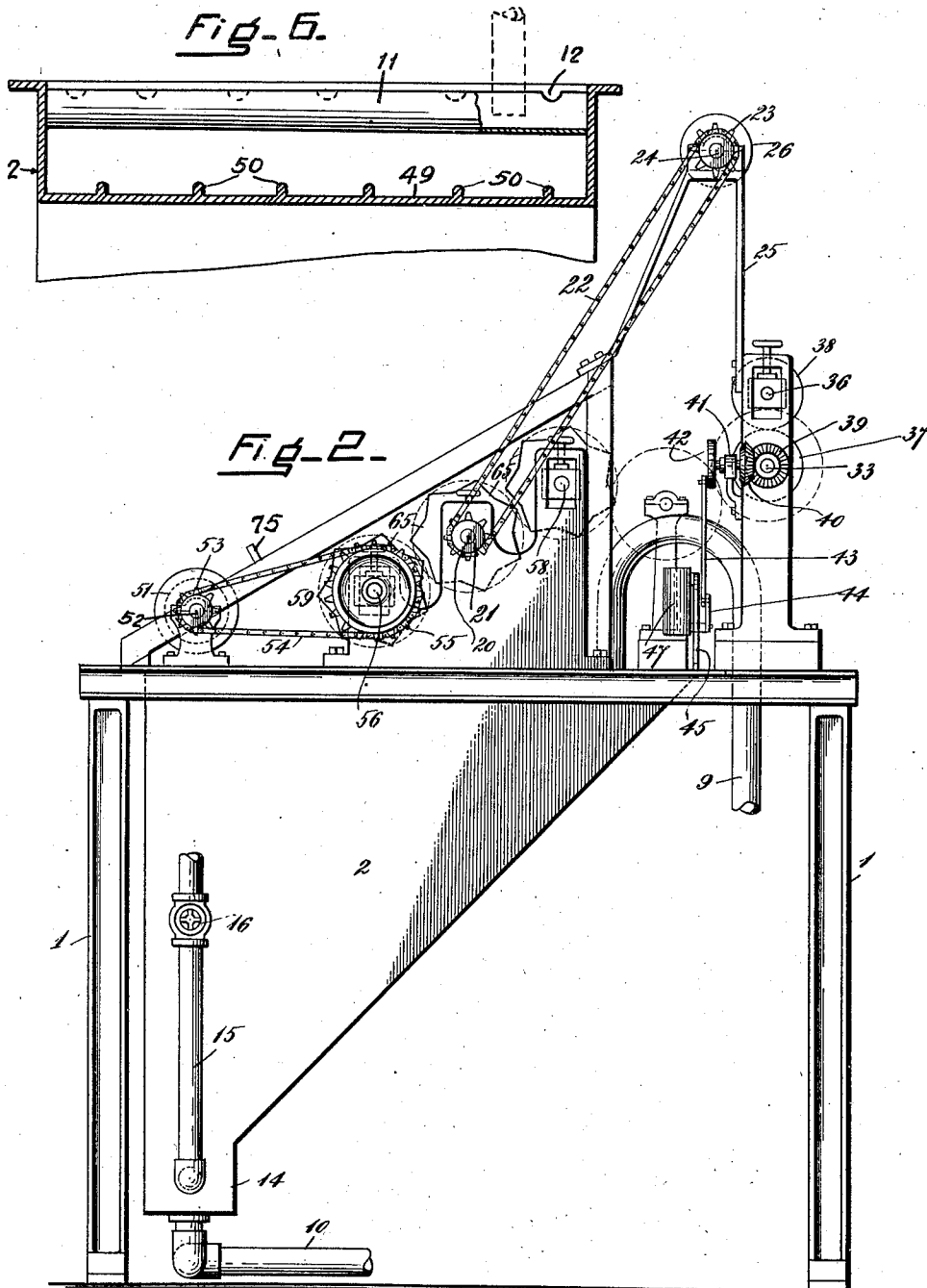
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METHOD AND APPARATUS FOR DYEING

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5 Sheets-Sheet 2



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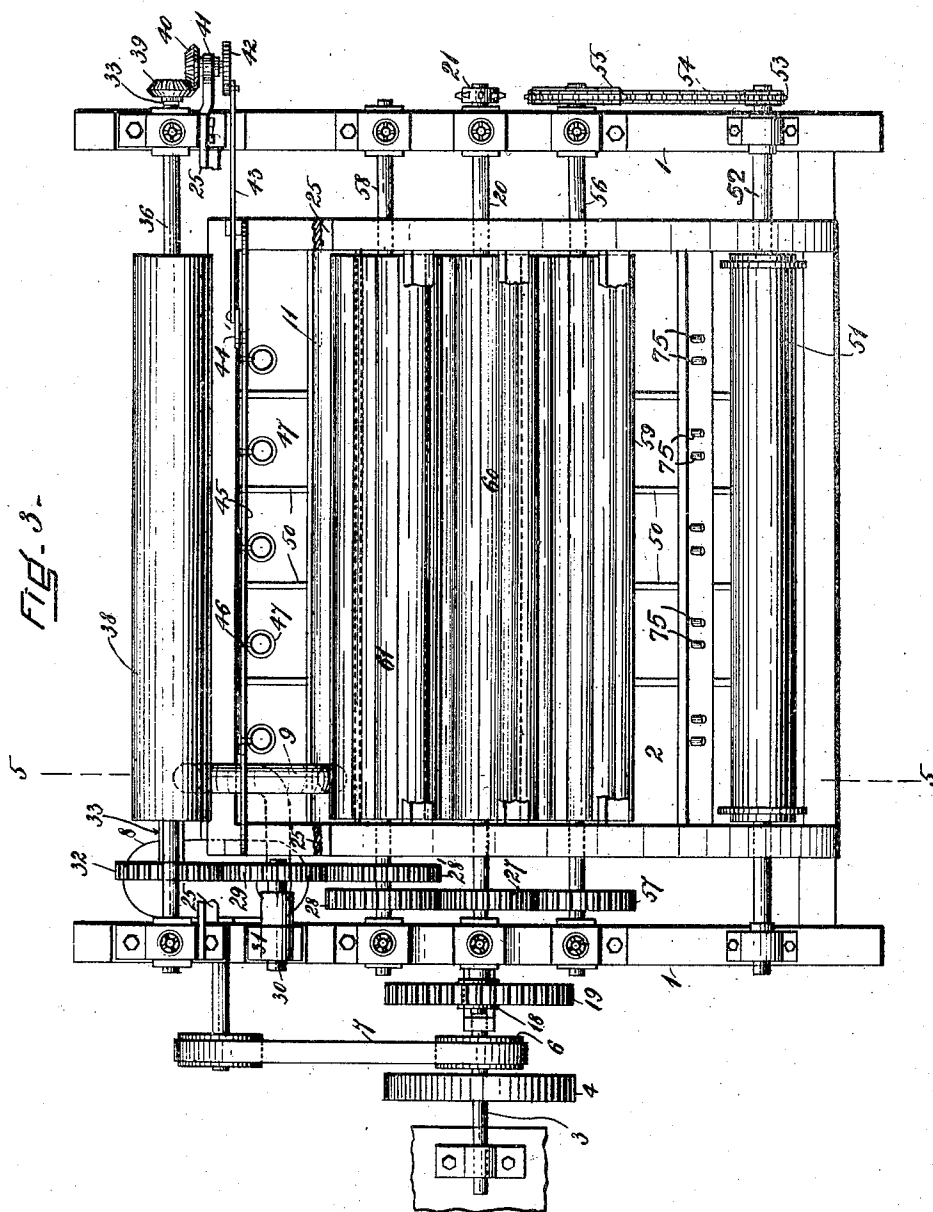
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METHOD AND APPARATUS FOR DYEING

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5 Sheets-Sheet 3



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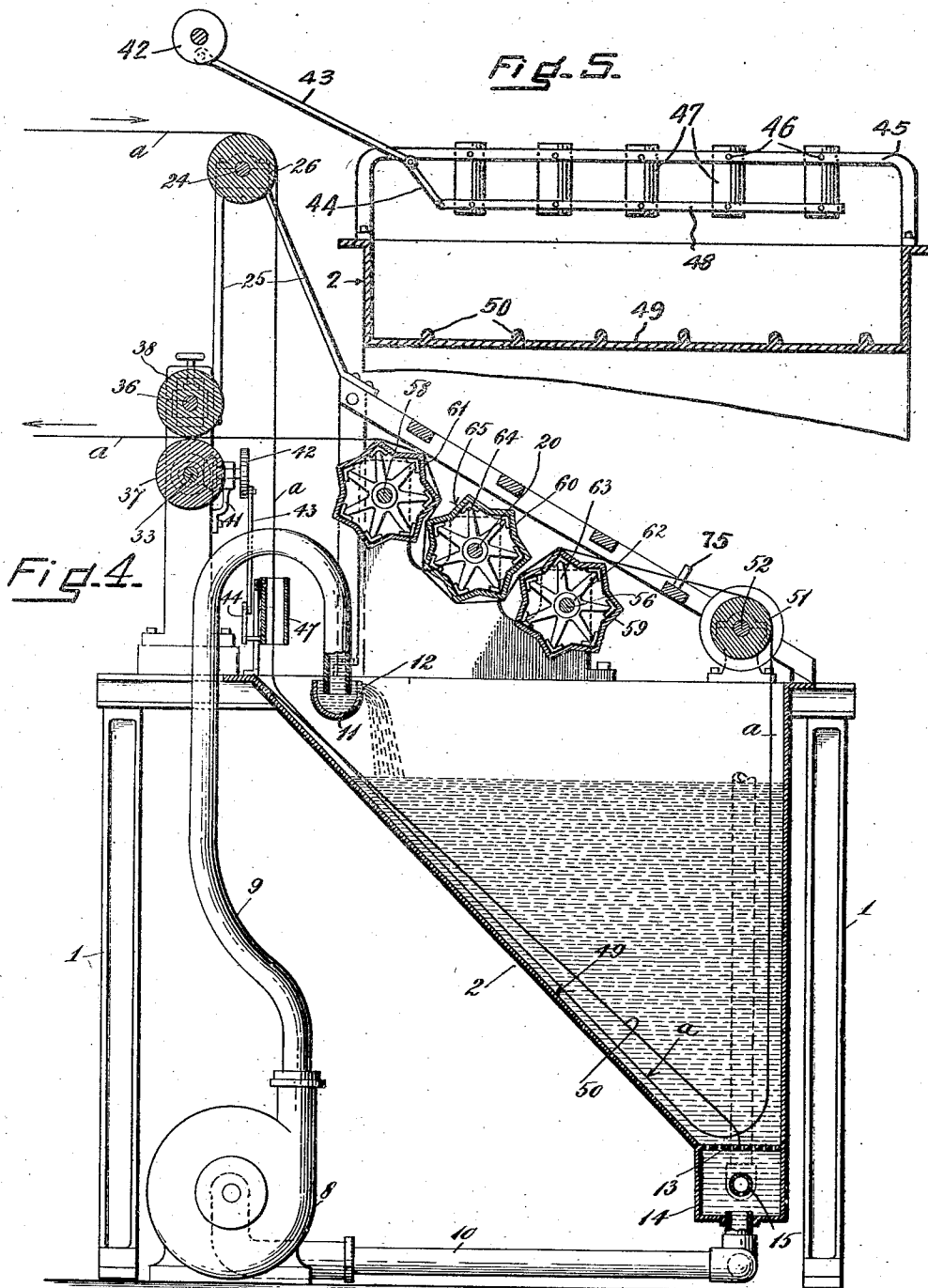
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METHOD AND APPARATUS FOR DYEING

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5 Sheets-Sheet 4



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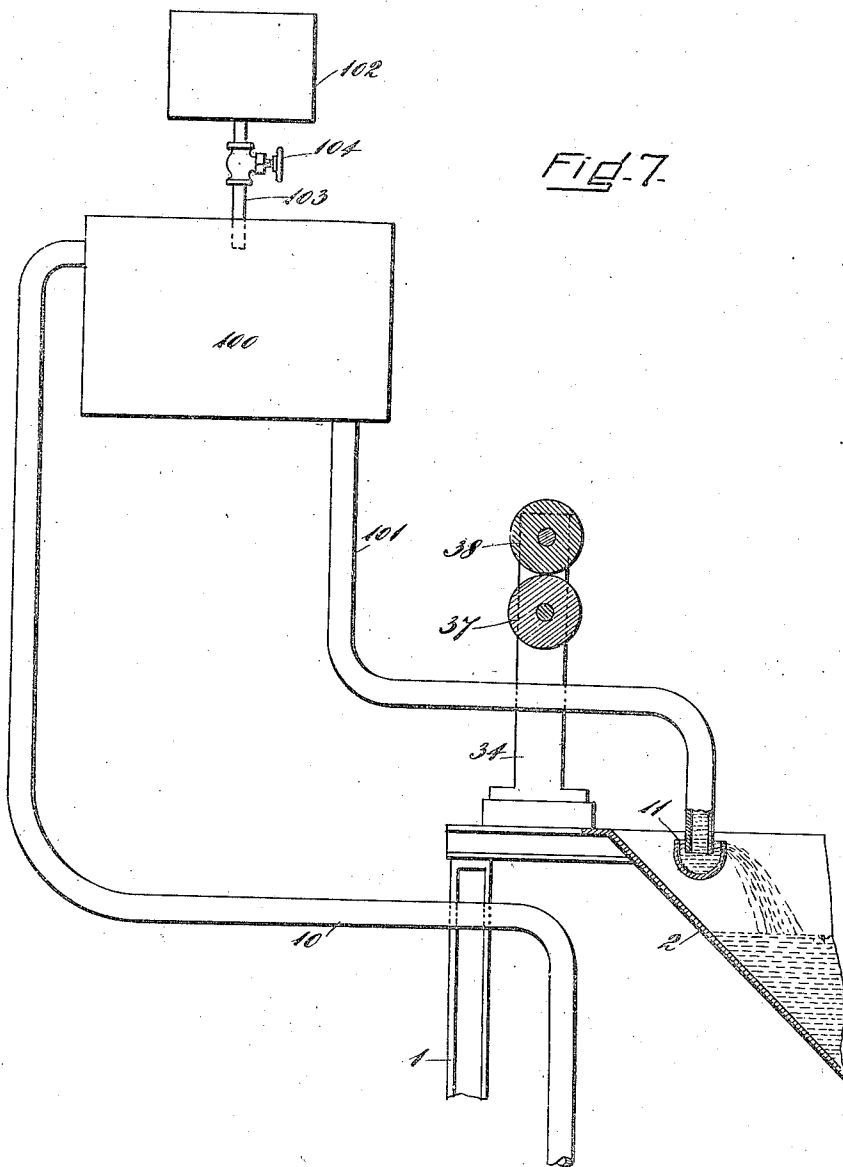
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METHOD AND APPARATUS FOR DYEING

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5 Sheets-Sheet 5



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METHOD AND APPARATUS FOR DYEING.

Application filed January 31, 1923. Serial No. 616,194.

My improvement relates to a new method of dyeing yarns and apparatus for carrying out my method, although in some of its aspects my invention may be otherwise used.

As shown it is embodied in a machine in which the yarn is fed loosely to the bath of dye which is in constant circulation. The yarn is afterwards squeezed to remove from it any excess of dye beyond that which the yarn may properly absorb. An opportunity is also afforded for the submission of the yarn thereafter to the action of the air whereby the dye may become more or less oxidized.

My invention will be understood by reference to the drawings, in which—

Figure 1 is a side elevation of a machine embodying my invention in its preferred form;

Fig. 2 being an elevation of the opposite side of the machine.

Fig. 3 is a plan, a portion of the supporting frame being omitted.

Fig. 4 is a vertical section on line 5—5 of Fig. 3, and

Figs. 5 and 6 details of the yarn feed and the dye feed, respectively.

Fig. 7 shows a modification.

In all these views 1, 1 are the uprights on which the dye tank 2 and other parts are supported. 3 is the power shaft carrying a pulley 4 connected by a belt 5 with a motor (not shown) or other source of power. On the shaft 3 is a pulley 6 connected by a belt 7 with a pump 8. From the pump leads a pipe 9 and to the pump leads a pipe 10 which is connected to the bottom of the tank 2. The pipe 9 feeds dye into a trough 11 which trough is supported between the side walls of the tank 2. This construction is such that the tank and connections being once filled with dye the dye is kept in constant circulation, flowing out from the bottom of the tank through the pipe 10 to the pump 8 and from thence up through the pipe 9 to the trough 11, from which it overflows back into the tank 2. The trough 11 has sluices 12 so that the dye will be fed back to the tank at different points along its entire width. A number of these sluices is desirable so that the incoming dye may be distributed more or less evenly at a number of points across

the width of the tank. The circulation may be otherwise as described below.

It will be noted from Figs. 1, 2 and 4 that the tank is substantially triangular in cross section, a grating 13 being located near its lowest portion, below which is a rectangular chamber 14 to which the pipe 10 is connected. In this chamber 14 runs a pipe 15 for regulating the temperature of the dye, which pipe may be connected with a suitable source of steam supply, for example. It carries a valve 16 by means of which the flow may be controlled. As shown that portion of this pipe which is within the chamber 14 is perforated so that minute quantities of steam may be discharged into the dye, though this is not essential. The pipe 17 continues the pipe 15 outside the tank and leads off to allow the steam to circulate.

The shaft 3 also carries a pinion 18 which meshes with a gear 19 upon the shaft 20. On the further end of this shaft 20, which runs across over the tank and is supported in the frame, is a sprocket 21 which is connected by a suitable chain 22 with a sprocket 23 on shaft 24 mounted in uprights 25 affixed to the top of uprights 34 and the frame. This shaft 24 runs across the machine and carries a guide roll 26 over which the yarns *a* are fed into the tank 2.

The shaft 20 also carries a gear 27 which meshes with a gear 28. This shaft also carries a gear 28' (see Fig. 3) in mesh with an idler 29. The idler 29 is fast on a shaft supported in uprights 31 on the frame. The idler 29 is in mesh with a gear 32 mounted on shaft 33 supported in the uprights 34, this shaft carrying the lower squeeze roll 37. The upper squeeze roll 38 is carried by shaft 36 adjustably mounted in uprights 34 and is in substantial contact with roll 37 to be operated thereby.

The shaft 33 carries at one end a bevel gear 39 which meshes with a second bevel gear 40 on the short shaft supported in the bracket 41 from the frame, and carrying at its other end a crank disk 42 pivotally connected by a connecting rod 43 with one end of a link 44.

To a portion of the frame 45 is pivoted at 46 a series of guide tubes 47 the lower ends

of which are pivotally connected together by a rod 48 to which the other end of the link 44 is pivotally connected (see Fig. 5). It will be seen that as the crank disk 42 rotates the connecting rod 43 is given a vibrating movement which is communicated by link 44 and rod 48 to the lower ends of the tubes 47 so that these tubes are given an oscillating movement around the pivots 46 and the yarn which is fed through it is constantly distributed in a backward and forward manner upon the slanting floor 49 of the tank 2. This floor is divided by ribs 50 which form stalls, each of which receives the yarn from one of the guide tubes 47 so that the yarn from the several guide tubes are kept apart, each yarn passing down in its own stall through the dye. Other means for feeding the yarn may be employed.

By this means it will be noted that the yarn is fed to the stalls and through the dye in its loose and natural condition under no tension so that the dye has the opportunity of thoroughly saturating the fibres of which the yarn is composed. It will be understood that where the yarn is fed into a dye bath under tension the outer portions of the yarn quite frequently are so stretched as to prevent the central portions of the yarn from being thoroughly permeated by the dye. By using the mechanism above described the yarn as it lies on and slides on the stalls 49 below the upper surface of the dye in the tank absorbs more or less of the dye evenly so that the yarn is drawn up from the tank with the dye quite evenly and thoroughly absorbed by it.

After the yarn has been passed through the dye in the manner above described it is carried up over a roll 51 and between guide pins 75. This roll 51 is on shaft 52, which shaft carries a sprocket 53 over which passes a chain 54 which runs over a sprocket 55 on the shaft 56, this shaft also carrying a gear 57 in mesh with the gear 27 on shaft 20.

The squeezers will now be described: Each of the shafts 20, 56 and 58 on which is the gear 28, carries a spider. The three spiders are numbered 59, 60 and 61. They are alike in that each comprises a hub 62 carrying arms 63, each arm having at its outer end an arrowhead 64. All these parts form a support for the plates forming the squeezing or stretching surfaces 65. These squeezers are all alike as will be seen from Fig. 4. They comprise plates arranged to form the periphery of the squeezers. The periphery of each squeezer is angular in character conforming to the shape of the arrowheads 64, the whole forming a continuous surface about the arrowheads. The several spiders are so arranged on the shafts that the several squeezing surfaces interlock as it were, the projecting portions of one squeezer being substantially opposite the recesses of

the next squeezer, and these squeezers are so close together that as the yarn *a* passes between them it is diverted from a straight line, this diversion being such as to stretch the yarn somewhat and squeeze out of it some of the dye which it carries. Thus any unabsorbed dye which it may carry is squeezed out of it falling back into the tank. The rolls 37 and 38 act as wringer rolls so that as the yarn leaves the machine it does not carry any surplus liquor. The yarn is then ready for further treatment.

It will be noted that in the above described machine both the dye and the yarn are kept moving automatically so that opportunity is offered for thorough dyeing of the yarn. In some cases it is very desirable that the dye should be renewed. For this purpose I have used the arrangement shown in Fig. 7 where the pipe 10 instead of running directly to the trough 11 runs to the renewal tank 100 from which the pipe 101 leads to the trough 11. Above the renewal tank 100 is a supply tank 102 which is provided with drip pipes 103 in which is a valve 104.

In practice the supply tank 102 is filled with strong dye and the valve 104 is adjusted to allow a constant dripping or stream of the strong dye according to the requirements of the situation to flow into the renewal tank 100 while it mingles with the more or less exhausted dye liquor as it passes through the renewal tank and keeps it up to the required strength. The tanks 100 and 102 may be of any desired relative size and other means than the pipe 103 may be provided if thought best to allow the dye to dribble from the tank 102 to the tank 100.

It is evident that my invention may be otherwise embodied, one element of its novelty lying in the moving of the yarn in unstretched condition through the dye so that it will be penetrated thoroughly by the dye.

In practice a leader is attached to each strand or set of strands and is carried over the roll 26 down into the tank and up over the roll 51 and between the squeezer rolls and out between the rolls 37 and 38. The leader is long enough to allow the entering ends of the strands to remain in the dye long enough to be thoroughly dyed before they are drawn out by the leaders.

It will be noted that in the normal operation of my machine the dye is not only kept in circulation and up to its standard strength, but the yarn is automatically kept in motion so that all parts of it are brought in thorough contact with the dye. Moreover, the tank may be made of considerable width so as to provide for quite a number of stalls into which an equal number of yarns may be fed, the process of dyeing a large number of yarns requiring but little

attention on the part of the operator and no more time than if a small number were being dyed.

In the practical operation of dyeing yarns in the above machine the yarns are led in through the guide tubes (if guide tubes are used) into the stalls down which they slide in loose condition. A number of strands may be fed at once into a stall. After they have been in the dye a sufficient length of time to impregnate them thoroughly, their ends are drawn out over the roll 51 and between the squeezers, preferably as indicated in Fig. 4, so that the yarns are more or less compacted by stretching, and then run between the rolls 37 and 38 where they are compressed to remove any surplus liquor after which they are carried off for further treatment.

As the speed of the feed rolls and the draft mechanism is equal all the yarn as it passes through the machine remains in the tank 2 an equal length of time. The dye in the tank is always in circulation and is kept at constant strength by the addition of fresh dye.

Thus the yarn is never under tension from the time it leaves the roll 26 until it passes over the roll 51 and between the squeezers, so that while in the dye it is entirely loose and can be thoroughly permeated by the dye.

As stated above, my invention may be otherwise embodied, but the above describes a method and machine which have proved very satisfactory in use, and which broadly speaking may be utilized for dyeing or otherwise treating other textiles than yarns with a liquid.

Five stalls 45 only are shown, but it is evident that the machine may be made wider so that a greater number of yarns may be dyed at a time. The stalls are wide enough to receive a considerable number of yarns as fed to them from the tubes which lay them in the stalls in zigzag or loose condition in which they slide down into the dye, the contents of one stall being kept out of contact with those in the stall next it by the ribs 50.

The said process and the machine above described, if built of proper proportions, may be used for treating woven or other fabrics as well as yarns and while in defining my invention in my claims I have used the term "yarn", I mean that term to include any material, such for example as cloth, capable of being treated in the manner described.

The word "progressively" is used by me in the sense that the yarn is not all stretched at once, but as it passes through the machine a portion of it is stretched at a time and in fact various degrees of stretching are applied to the yarn according to whether it is resting on one of the angles of one of the

squeezers or lies between two of the squeezers.

What I claim as my invention is:—

1. In an apparatus of the kind described, a dye tank, means for feeding yarn thereto in slack condition, means for withdrawing it therefrom and putting it under longitudinal stress whereby its fibres will be drawn into close contact with each other and the unabsorbed dye will be forced out from between them.

2. In an apparatus of the kind described, a dye tank, means for feeding yarn thereto in slack condition, means for withdrawing it therefrom, means for putting it progressively under both longitudinal stress and lateral pressure whereby its fibres will be drawn longitudinally into close contact and will also be pressed laterally to force out from the yarn any free dye held between the fibres, and means operable thereafter to place the fibres under pressure whereby unabsorbed dye will be squeezed out from the fibres.

3. A machine of the kind described comprising a dye tank, means for feeding yarn thereto in slack condition, and means for withdrawing it therefrom at the same speed with which it is fed thereto, whereby the yarn will be progressively fed and withdrawn therefrom at the same speed and while in the tank will remain in slack condition, said withdrawing means comprising means for stretching the yarn whereby its fibres will be brought into close contact with themselves and the dye carried between them will be caused to be dropped therefrom.

4. A machine of the kind described comprising a dye tank, means for withdrawing yarn therefrom, means for stretching the yarn comprising rollers having angular surfaces, said rollers being in close proximity and having their axes in the same plane whereby their angular surfaces will interlock the yarn, and means for squeezing the yarn whereby the excess moisture will be removed from the yarn.

5. A machine of the kind described comprising a dye tank, means for withdrawing yarn therefrom in loose condition, means for stretching the yarn comprising rolls having stretching surfaces located in close proximity whereby stretching surfaces on adjacent rolls will co-act to stretch the yarn, and means for squeezing the yarn whereby the yarn will be substantially dried, said stretching means being adapted to stretch the yarn progressively.

6. A machine of the kind described comprising a dye tank, means for withdrawing yarn therefrom in loose condition, means for stretching the yarn, and means for squeezing the yarn whereby the yarn will be substantially dried, said stretching means being adapted to stretch the yarn progressively, and comprising a series of stretching rolls

having angular surfaces and arranged with their axes in substantially the same plane whereby the apices of one roll will enter the recesses in the next roll. means for withdrawing said article from said tank at a speed substantially equal to its speed of feed, and means for stretching said article, and means for compressing it whereby it will be delivered from said machine without any excess of moisture.

- 5 7. A dyeing machine comprising a dye tank, means whereby the article to be dyed may be fed loosely to said tank and maintained while therein in loose condition,

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